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CO₂ emission calculation conditions and definitions (SMC's calculation method)

- The amount of greenhouse gases emitted during the production of raw materials converted, into CO₂ emissions is displayed as [kg-CO₂e].
- Calculation by the LCI database

The LCI (life cycle inventory) data—which is a quantitative assessment of the amount of emissions emitted during a product's life cycle (production, usage, disposal, etc.) takes into account the amount of resources and energy used in each process as well as various environmental impacts

Source: LCI database IDEA version 2.3 (2019/12/27): National Institute of Advanced Industrial Science and Technology
The Research Institute of Science for Safety and Sustainability's Research Laboratory for IDEA, Sustainable Management Promotion Organization

SMC's CO₂ Emission-Reducing Initiatives

Production process and product performance improvements with a focus on the environment

Over the past several years, SMC has continued to take on its social responsibility to seriously promote and support sustainability in order to minimize negative impacts to the environment.

SMC is always looking to develop newer and greener solutions with CO₂ reduction as a top priority as a leader in the field of pneumatics. One of the key components of our comprehensive approach is the designing of compact and lightweight products. Smaller, lighter products require less raw materials to make and less time to process. In addition, the products themselves use less energy.

All of these efforts contribute to reduced CO₂ emissions.

SMC's fully integrated technical, production, and sales departments are able to respond to the needs of our customers from around the world with a shared goal of finding new methods to effectively protect the environment.

SMC's CO₂ emission-reducing initiatives also include the promotion of eco-friendly factories and products. In addition, SMC promotes the reduction of CO₂ emissions in our operations.

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97%
Labor
Reduction

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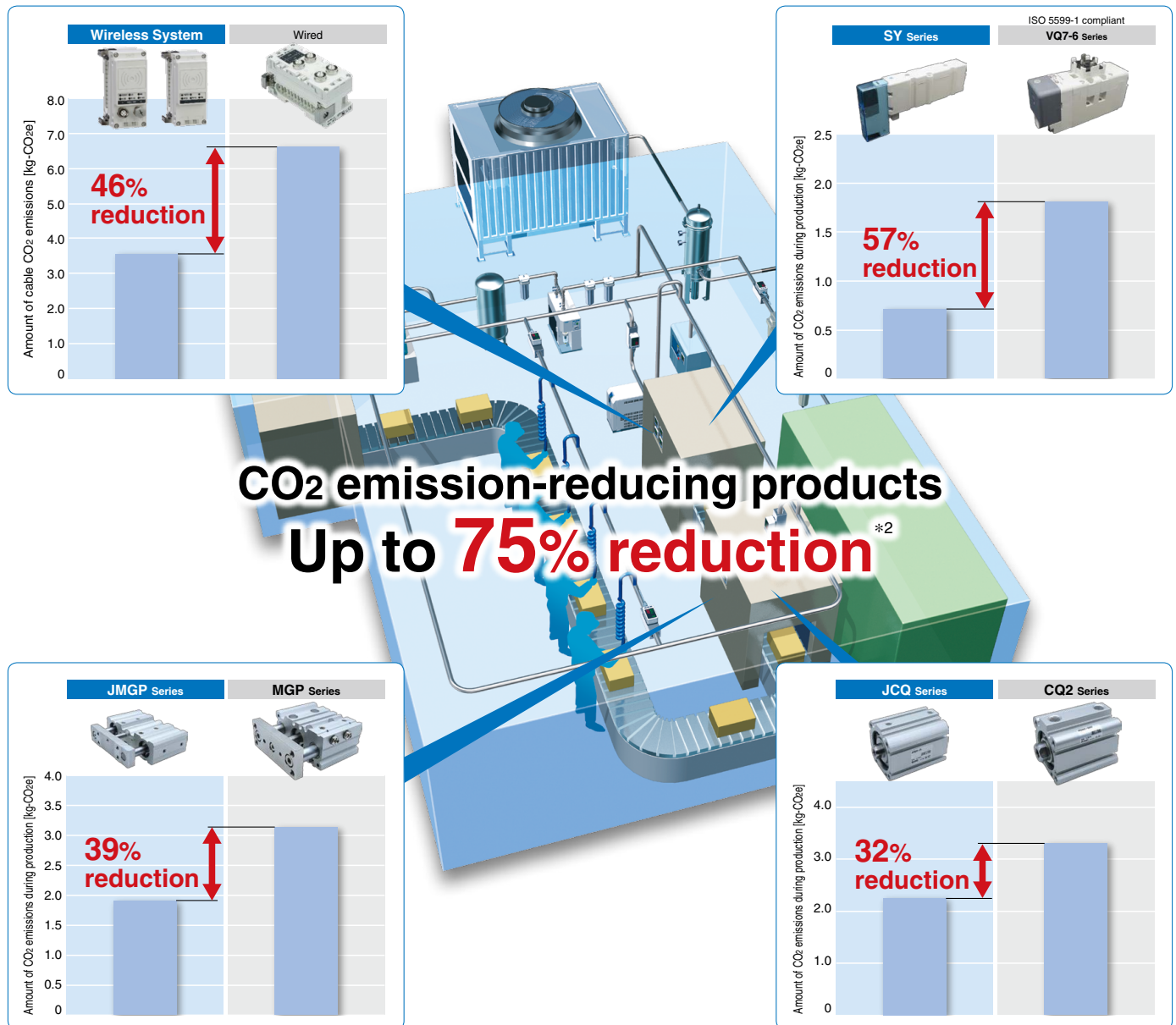
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CO₂ Emission-Reducing Products

With SMC's use of topology optimization*¹ in the design process, more compact, lightweight products can be realized compared with existing products, resulting in a large reduction in the amount of CO₂ emissions during production. In addition, these products can also contribute to energy saving and CO₂ reduction during usage.

*¹ Topology optimization is the methodology of finding the most efficient design for an object on a mathematical and mechanical basis.



*² For low wattage valves with power-saving circuit (Refer to page 18.)

The benefits of using compact, lightweight products:

By using compact, lightweight products, you can **minimize the size and weight of devices!**

CO₂ emission reduction

By using compact products, you can **make efficient use** of factory space!

By using lightweight products, you can reduce tact time and **improve productivity!**

Eco-Products

SMC is dedicated to the production of environmentally friendly products that reduce environmental impacts. This is done from the design and development phases until the end of the product life cycle. With product assessments, we evaluate the environmental impact of our products in terms of resource savings (smaller, lighter), product longevity, energy savings, safety, variations, amount of packing materials, and waste disposal in order to develop environmentally sound products.

Resource-saving

No communication cables required. [p. 9](#)



Weight: Up to 54% lighter [p. 10](#)



Long Service Life

Service life:
200 million cycles (Metal seal)



Energy saving

Power consumption reduced by 34% (Energy saving)*1

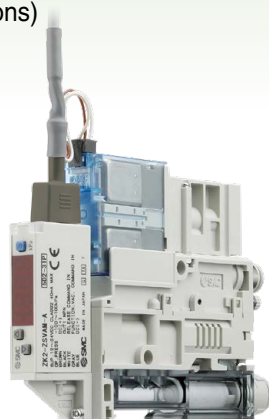


*1 Under the conditions shown on the [Web Catalog](#)

Air Saving

93% reduction in air consumption
(Under SMC's measurement conditions)

Air consumption reduced with an energy efficient vacuum pressure switch and ejectors.



87% reduction in air consumption
(Under SMC's measurement conditions)

Impact force increased with higher peak pressures that allows for a drastic reduction in air consumption and labor time.



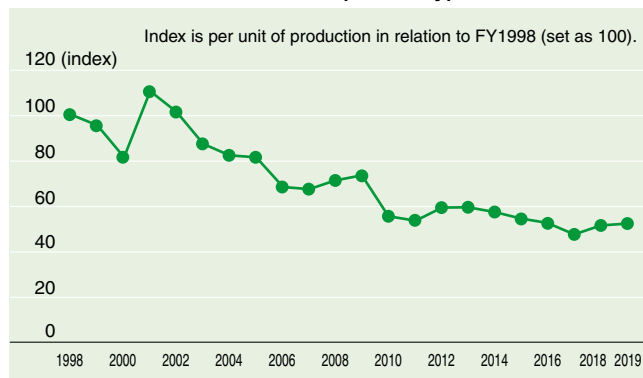
Eco-Factory

SMC has implemented ISO 14001, the international standards related to environmental management, and began to make organizational efforts in implementing environmentally friendly and energy-saving measures at our factories since 1998 (acquired certification in December 1999).

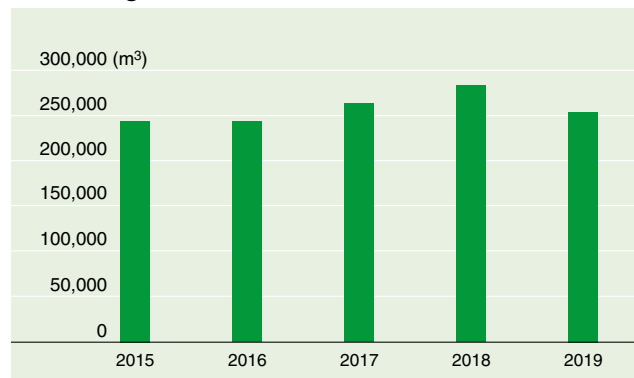
Energy Consumption, CO₂ Emissions and Water Usage

The largest source of CO₂ emissions in SMC's business activities is from the use of electricity. SMC aims to reduce the emission of CO₂ through the combined effect of its steady energy-saving efforts.

Reduction of CO₂ emissions (intensity)



Water usage



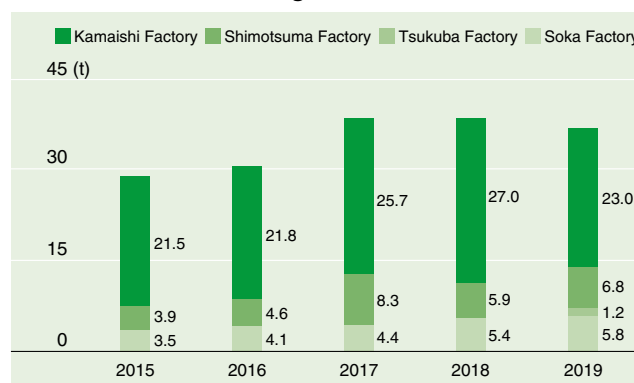
Proper Management of Chemical Substances

SMC strives to eliminate the use of CFCs by switching to alternatives with lower GWP values, and to reduce the overall use of chemical substances (through prevention of evaporation, prevention of removal, and reuse).

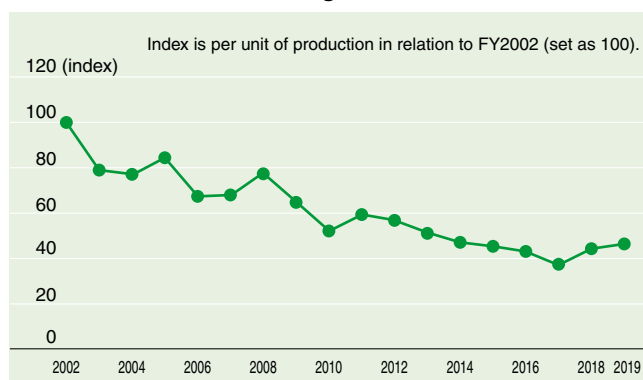
Waste discharge



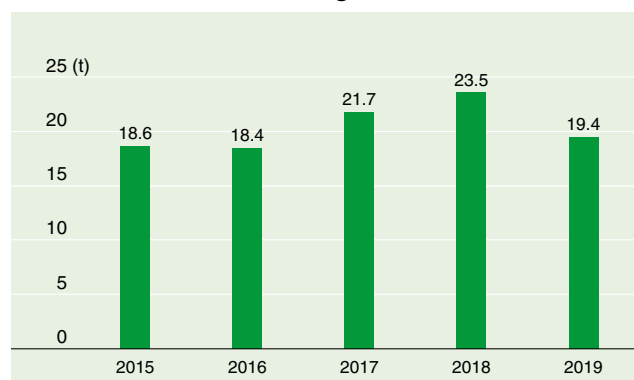
Chemical substance usage



Reduction of waste discharge



Chemical substance discharge



About Specified Businesses

- 1 SMC is designated as a Specified Business under the Act on Rationalizing Energy Use. Furthermore, our Soka 1st Factory, Tsukuba 1st Factory, Tsukuba Technical Center, Kamaishi Factory, Kamaishi 4th Factory, Tono Factory and Yamatsuri Factory are designated as Designated Energy Management Factories as the energy consumption at each factory for a given business year is 1,500 kL (crude oil equivalent) or more.
- 2 Specified Businesses and Designated Energy Management Factories are obliged to establish targets to reduce their energy consumption by 1% or greater per year, as well as to manage energy consumption on an organizational basis and submit periodic reports.

Reduction of Industrial Wastes

SMC practices strict waste sorting and promotes the 3Rs - Reduce, Reuse and Recycle. SMC sells computers and printers, which are no longer used, as material of value to recycle operators and reducing its waste disposal costs.

Example of sorting

- plastic waste
- paper
- vinyl chloride
- rubber
- noncombustible items
- corrugated boards



Material Balance

SMC keeps track of the environmental burdens generated through consumption of resources and energy during the design, development and manufacturing of its products.



*1 CO₂ from production activities is the amount of CO₂ emitted associated with energy usage.

*2 Recycle refers to the amount that is discharged as material of value and reused and/or recycled as materials and thermal energy.

Designated as a Large-Scale Facility

A regulation regarding annual energy consumption is stipulated in a plan to prevent climate change set forth under Saitama Prefecture's ordinance. Facilities with energy consumption that exceeds the equivalent of 1,500 kL of crude oil per year for three consecutive years are designated as a large-scale facility and are required to reduce their energy consumption. SMC's Soka 1st Factory was designated as a large-scale facility in FY2019 as its energy consumption exceeded the equivalent of 1,500 kL for three consecutive years in FY2016–2018

Initiatives at Each Factory

SMC uses flow switches, its own products, to monitor the air flow rates at each factory to enable early detection of air leaks due to equipment failure. SMC is also working on improving energy efficiency. Its effort include the use of mechanisms that automatically shut off the air source during plant downtime, which reduced the use of purge air*1 by 30% (compared to our conventional operation).

*1 The air used to discharge the remaining air from air pipes when a plant starts operation.

Green Procurement

SMC recognizes that conservation of the global environment is a common issue for all humanity and a matter that demands the consideration of management.

SMC will develop and supply environmentally friendly products in order to continually reduce the environmental burdens in accordance with its basic philosophy: "SMC strives to undertake environmental conservation activities through pneumatic technology that contributes to automation in all fields of industry in order to pass down a sustainable global environment to future generations".

As part of its initiatives, SMC conducts green procurement of products, materials, components, semi-finished goods, secondary materials, and packaging materials used in the design, development and production process.

Proposal for Air-saving System

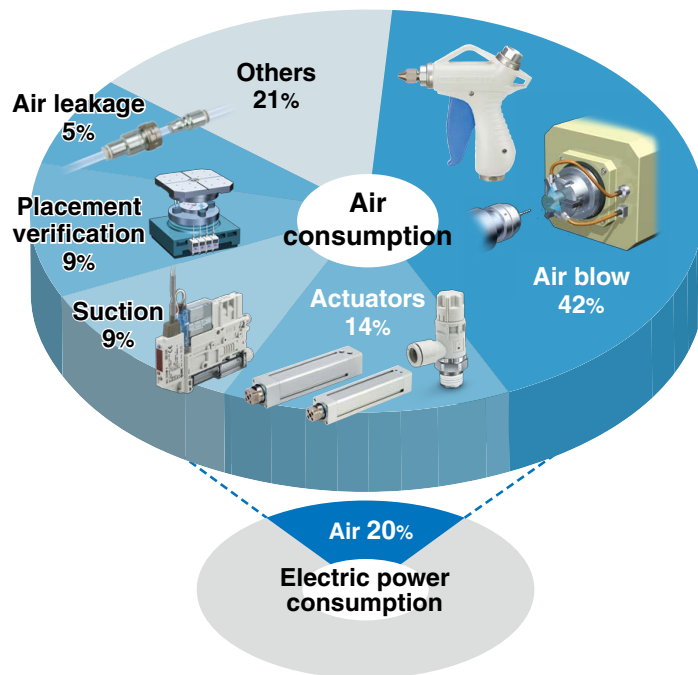
Contributes to
CO₂ emissions reduction

We will help you **save energy**.

The first step towards energy saving is understanding the current state of your factory. Improved awareness is key.

Did you know that air equipment accounts for about 20% of all factory power consumption? Air blow is the main factor, responsible for over 40% of all air consumption, with actuators accounting for 14% and suction 9%. Improved air blow efficiency can be achieved by selecting optimally sized piping. Similarly, air saving can be achieved by device optimization.

By allowing SMC to check on the state of your factory, we will be able to provide you with equipment and facility improvement proposals, factory management training, and access to a wide range of other useful services.



Success stories of companies that implemented measures for energy saving

Company A performance

Electricity consumption **3000 kW → 1400 kW**

CO₂ emissions **1900 t reduction/year**

Cost **JPY 48 million reduction/year**

Company B performance

Electricity consumption **10000 kW → 7000 kW**

CO₂ emissions **3500 t reduction/year**

Cost **JPY 90 million reduction/year**

* Companies in Japan. Amounts in Japanese yen. Electricity unit cost 15 JPY/kWh. Operating hour 2000 h/year. Electricity - CO₂ emissions conversion factor 0.587 kg - CO₂/kWh

* SMC research

Air-saving

Impact Blow Gun

Generates a higher peak pressure than conventional blow guns to reduce air consumption and labor time.

87% reduction in air consumption



Air-saving, long service life

Pulse Blow Valve

Contributes to efficient air blow by achieving repeated peak pressure with a simple air supply.

50% reduction in air consumption



Air-saving, noise reduction

Vacuum Unit

- ① Reduces air consumption with SMC's energy-saving digital pressure switch.
- ② Improved noise reduction with SMC's silencer.

93% reduction in air consumption



Air-saving, supports preventive and predictive maintenance

IO-Link Compatible 3-Screen Display Digital Gap Checker

- ① When workpieces are seated, the product does not exhaust air, dropping air flow consumption down to 0 L/min.
- ② Process data including the displayed supply, and exhaust values are retrieved to contribute to preventative and predictable maintenance.

60% reduction in air consumption.



Air-saving, noise reduction

Booster Regulator

Compressed air used to operate the drive chamber can be reused via the exhaust return circuit, resulting in lower air consumption and reduced noise.

40% reduction in air consumption
80% reduction in operation noise



Energy saving, space-saving

Thermo-chiller

(Dual Channel Refrigerated Thermo-chiller for Lasers)

- ① Adopted an inverter control and a heaterless heating function for energy-savings.
- ② Temperatures for 2 fluid channel systems can be controlled individually by one chiller, contributing to space-saving.

30% reduction in power consumption



- SMC promotes the reduction of packaging materials, repeated use and review of materials (selection of materials containing less amount of substances that generate toxic gas upon disposal).
- SMC gives consideration to the disposal of its products by improving decomposability and reducing of the variations of the materials used.
- SMC discloses to its customers information on the content and use of substances of concern in its products.

**During the
production process**

CO₂ Emission-Reducing Products

With SMC's use of topology optimization*1 in the design process, more compact, lightweight products can be realized compared with existing products, resulting in a large reduction in the amount of CO₂ emissions during production.

In addition, these products can also contribute to energy saving and CO₂ reduction during usage.

*1 Topology optimization is the methodology of finding the most efficient design for an object on a mathematical and mechanical basis.

Cableless

Wireless System

Communication cables
not required



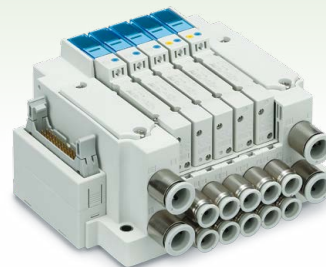
Compact and Lightweight



JCQ Series



JCM Series



JSY Series



AF Series



JMGP Series



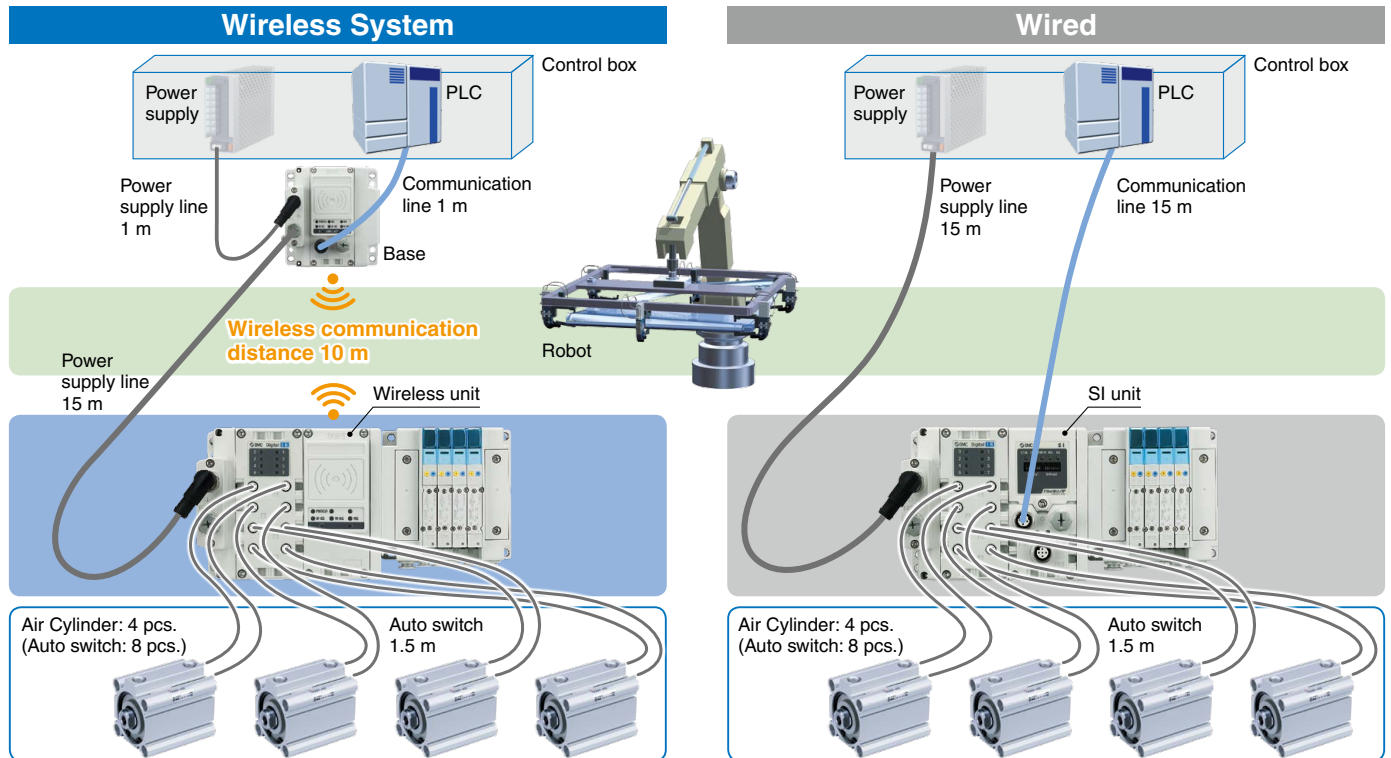
KQ2 Series

Comparison with
existing products
(Cableless)

Example of CO₂ Emissions Reduction 1

Communication cables not required

Reduced wiring labor, space savings, with minimized disconnection risk.

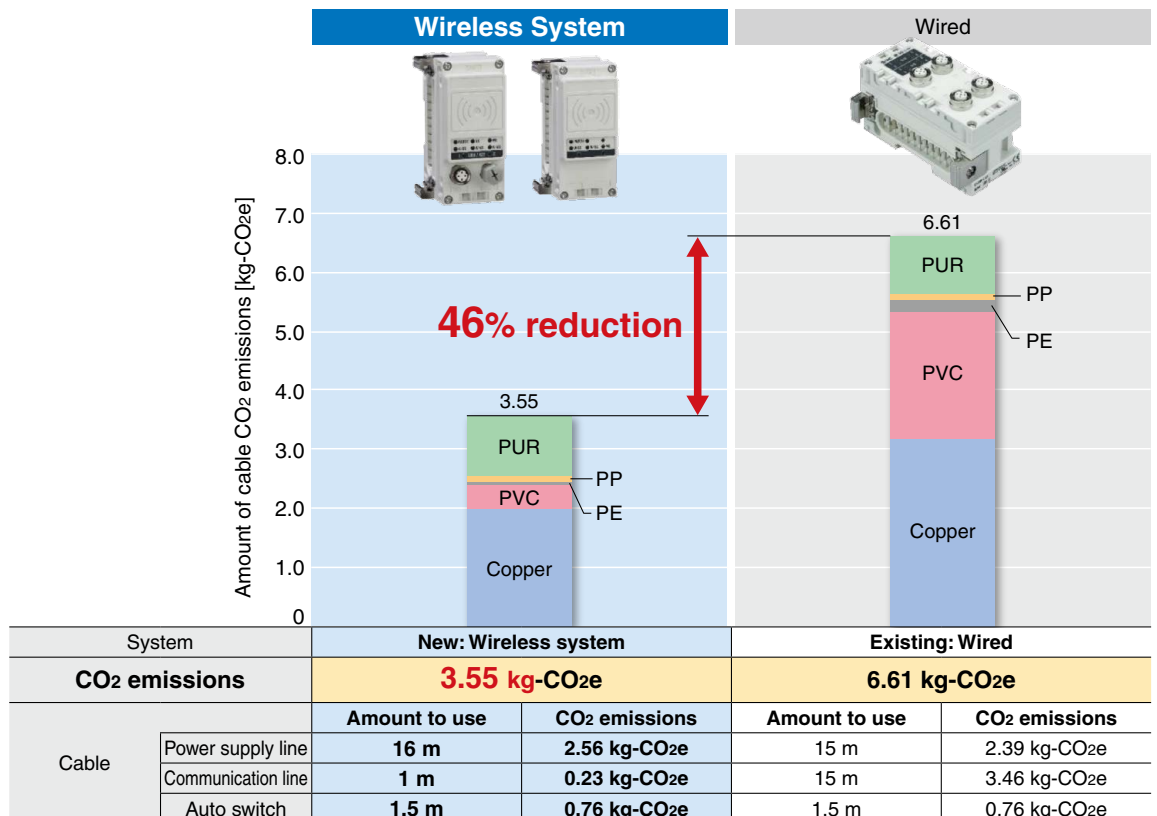


* The communication wiring distance refers to the actual wiring distance not the wireless communication distance. (The max. wireless communication distance is 10 m.)

Wireless System EX600-W Series

CO₂ emissions: Up to **46% reduction**

PP : Polypropylene
PE : Polyethylene
PVC : Polyvinyl chloride
PUR : Polyurethane



* For details on CO₂ emission calculation conditions (SMC's calculation method), refer to page 1.

Comparison with
existing products
(Compact products)

Example of CO₂ Emissions Reduction 2

With SMC's use of topology optimization in the design process, more **space-saving**, **lightweight** products can be realized with the same bore size and stroke as existing products.



Large reduction in the amount of CO₂ emissions during production

Overall length shortened



Lightweight

Up to

54% lighter

0.69 kg → 0.32 kg

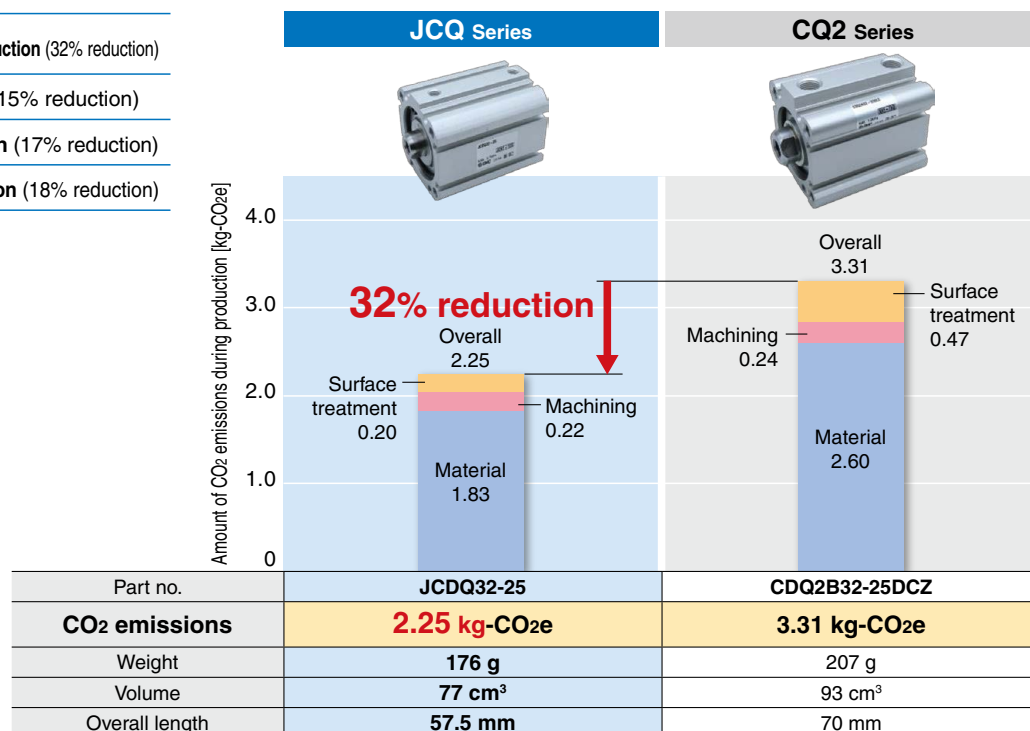
(Compared with the existing CM2B series, ø40, 50 mm stroke)



Compact Cylinder JCQ Series

CO₂ emissions: **32% reduction**

CO ₂ emissions	1.06 kg-CO₂e reduction (32% reduction)
Weight	31 g reduction (15% reduction)
Volume	16 cm³ reduction (17% reduction)
Overall length	12.5 mm reduction (18% reduction)

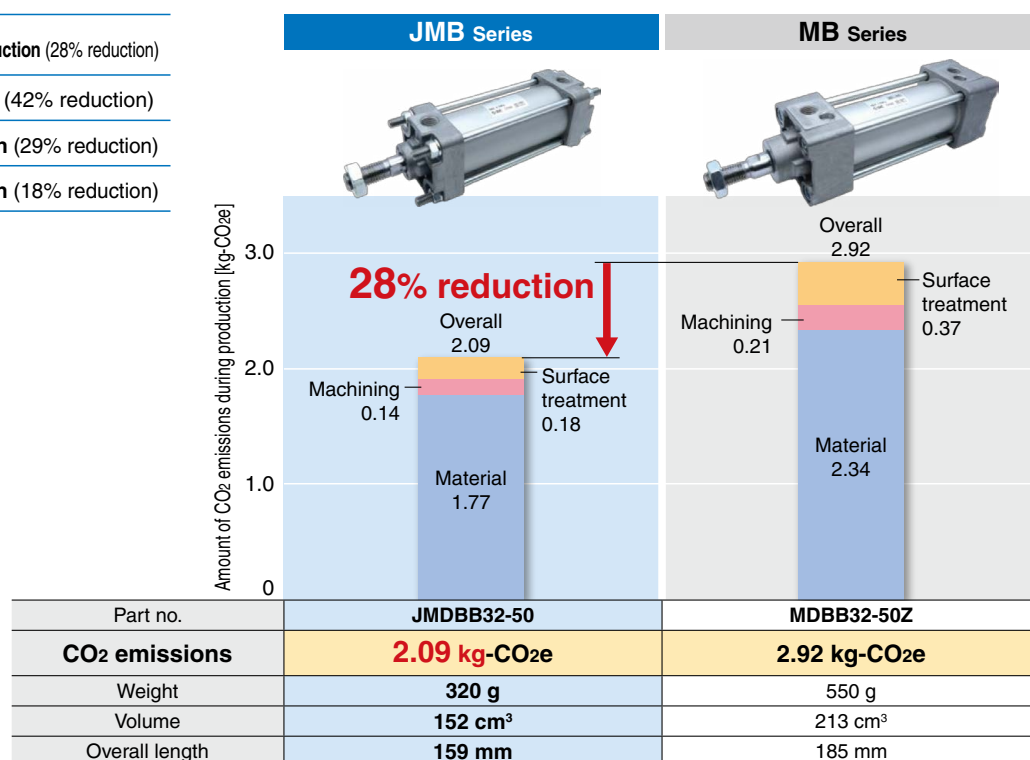


* For details on CO₂ emission calculation conditions (SMC's calculation method), refer to page 1.

Air Cylinder JMB Series

CO₂ emissions: **28% reduction**

CO ₂ emissions	0.83 kg-CO₂e reduction (28% reduction)
Weight	230 g reduction (42% reduction)
Volume	61 cm³ reduction (29% reduction)
Overall length	26 mm reduction (18% reduction)

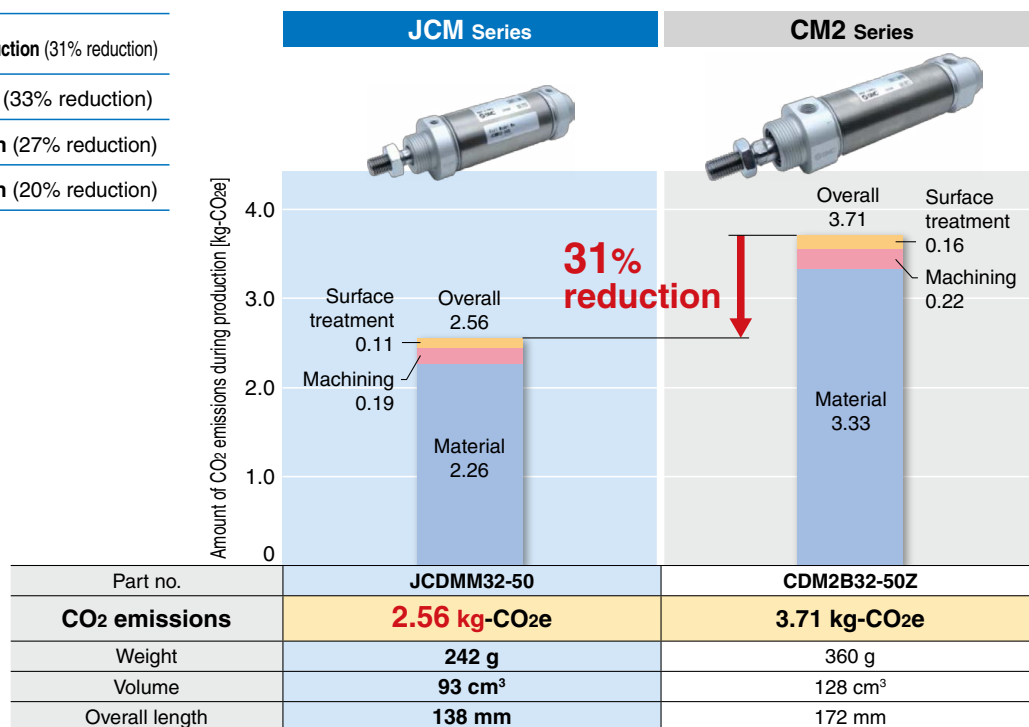


* For details on CO₂ emission calculation conditions (SMC's calculation method), refer to page 1.

Air Cylinder JCM Series

CO₂ emissions: **31% reduction**

CO ₂ emissions	1.15 kg-CO₂e reduction (31% reduction)
Weight	118 g reduction (33% reduction)
Volume	35 cm³ reduction (27% reduction)
Overall length	34 mm reduction (20% reduction)

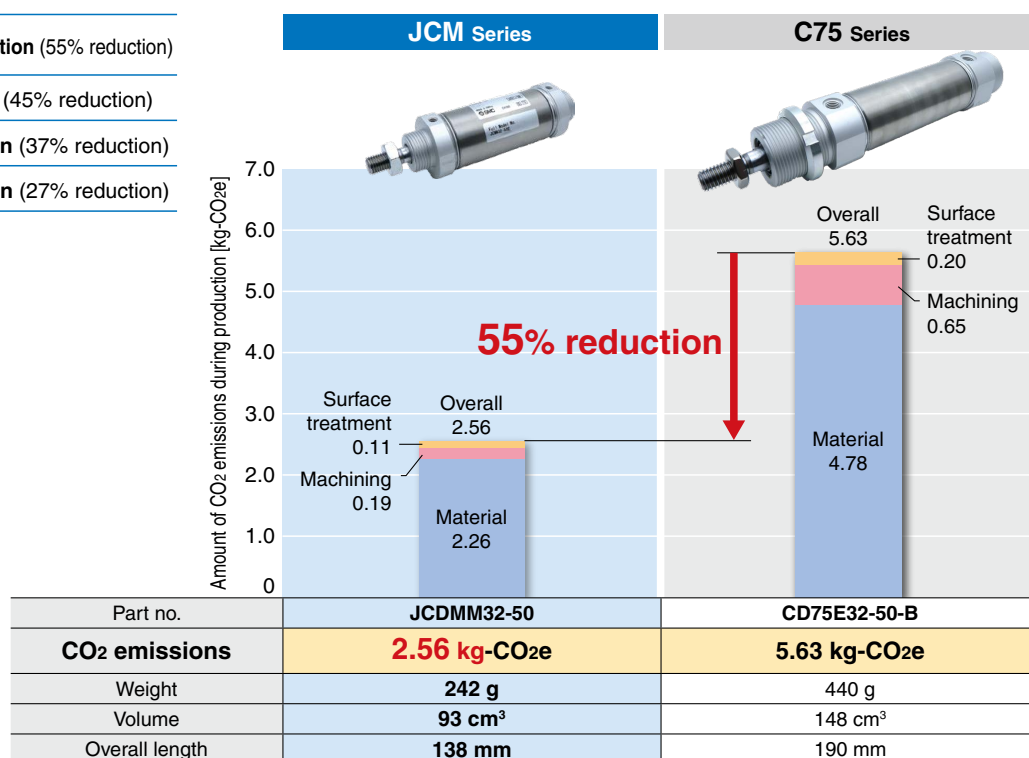


* For details on CO₂ emission calculation conditions (SMC's calculation method), refer to page 1.

Air Cylinder JCM Series

CO₂ emissions: **55% reduction**

CO ₂ emissions	3.07 kg-CO₂e reduction (55% reduction)
Weight	198 g reduction (45% reduction)
Volume	55 cm³ reduction (37% reduction)
Overall length	52 mm reduction (27% reduction)

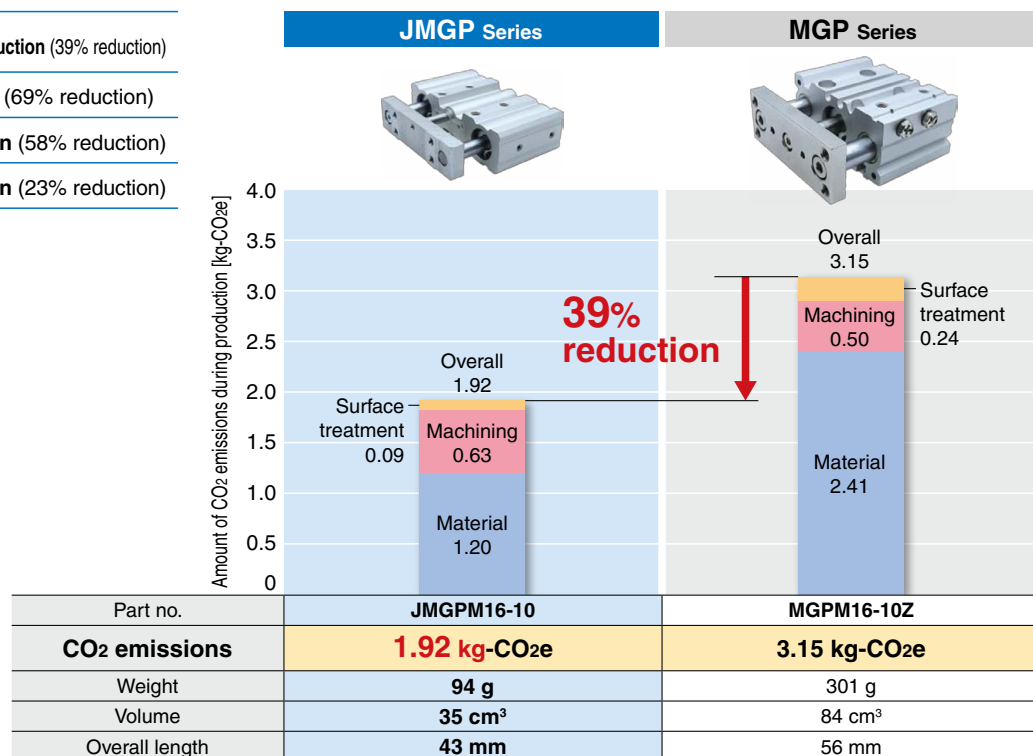


* For details on CO₂ emission calculation conditions (SMC's calculation method), refer to page 1.

Compact Guide Cylinder JMGP Series

CO₂ emissions: **39% reduction**

CO ₂ emissions	1.23 kg-CO₂e reduction (39% reduction)
Weight	207 g reduction (69% reduction)
Volume	49 cm³ reduction (58% reduction)
Overall length	13 mm reduction (23% reduction)

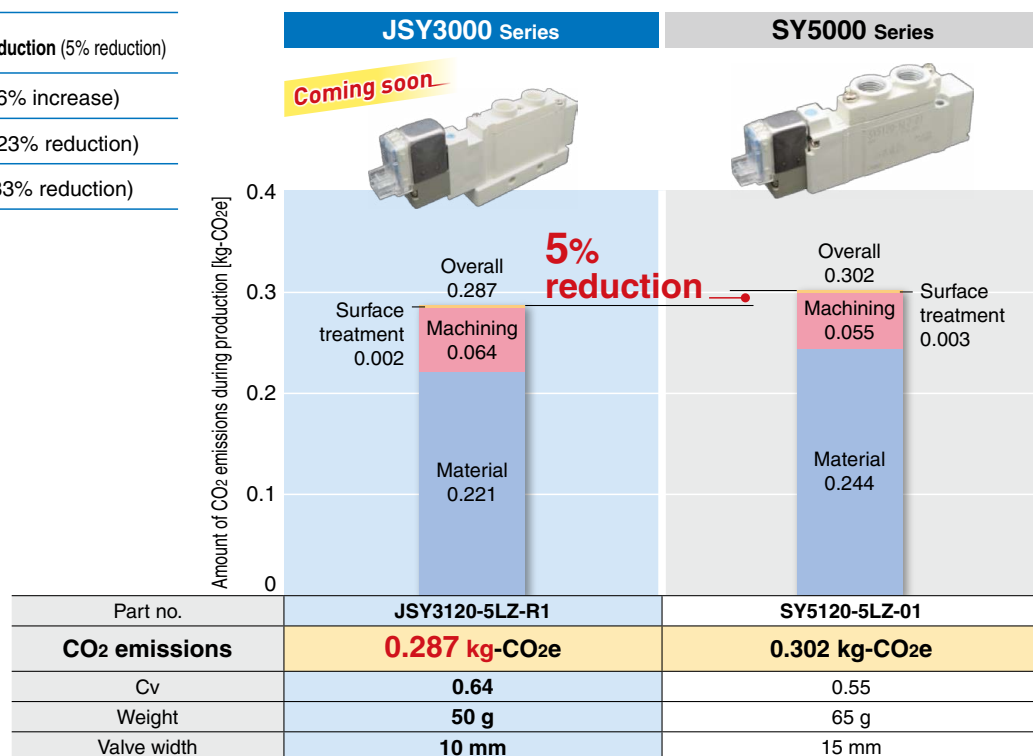


* For details on CO₂ emission calculation conditions (SMC's calculation method), refer to page 1.

5-Port Solenoid Valve JSY Series

CO₂ emissions: **5% reduction**

CO ₂ emissions	0.015 kg-CO₂e reduction (5% reduction)
Cv	0.09 increase (16% increase)
Weight	15 g reduction (23% reduction)
Valve width	5 mm shorter (33% reduction)

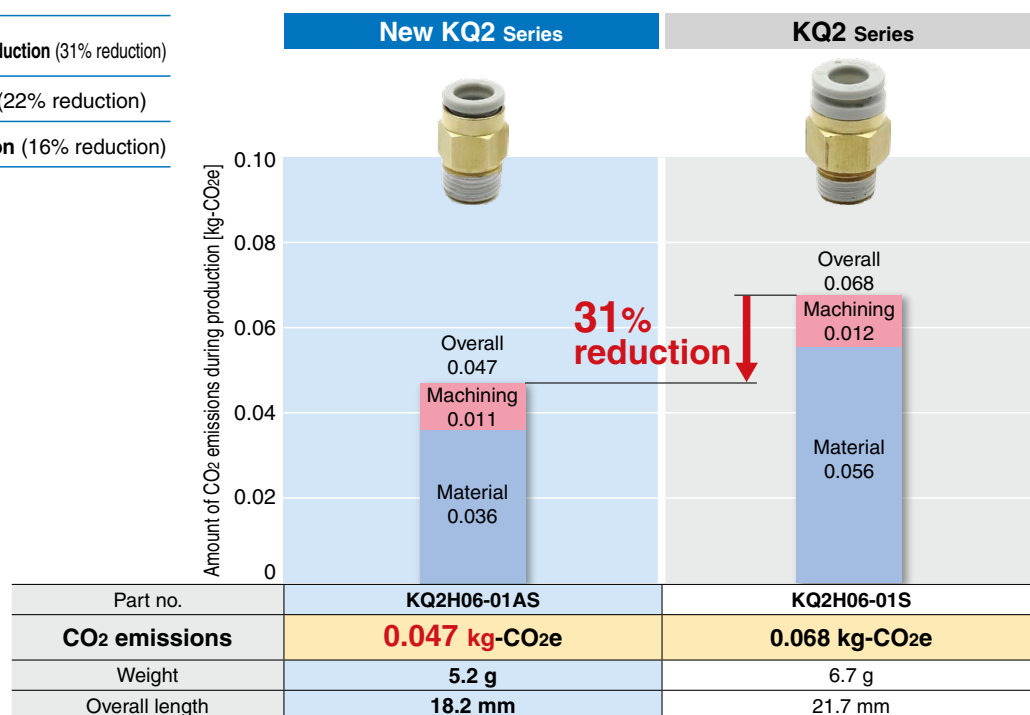


* For details on CO₂ emission calculation conditions (SMC's calculation method), refer to page 1.

One-touch Fittings KQ2 Series

CO₂ emissions: **31% reduction**

CO ₂ emissions	0.021 kg-CO₂e reduction (31% reduction)
Weight	1.5 g reduction (22% reduction)
Overall length	3.5 mm reduction (16% reduction)

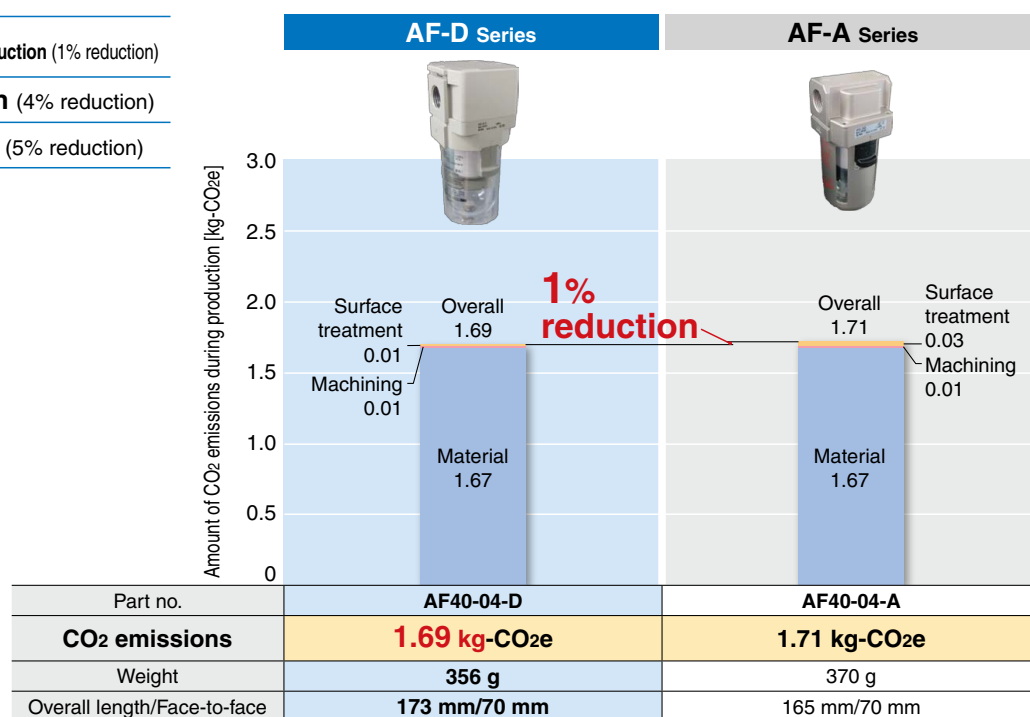


* For details on CO₂ emission calculation conditions (SMC's calculation method), refer to page 1.

Air Filter AF Series

CO₂ emissions: **1% reduction**

CO ₂ emissions	0.02 kg-CO₂e reduction (1% reduction)
Weight	14 g reduction (4% reduction)
Overall length	8 mm reduction (5% reduction)



* For details on CO₂ emission calculation conditions (SMC's calculation method), refer to page 1.

Example of CO₂ Emissions Reduction 3

With SMC's use of topology optimization in the designing process, more **space-saving**, **lightweight** products can be realized compared with existing ISO standard-compliant products.



Large reduction in the amount of CO₂ emissions during production

SMC vs. ISO Standards

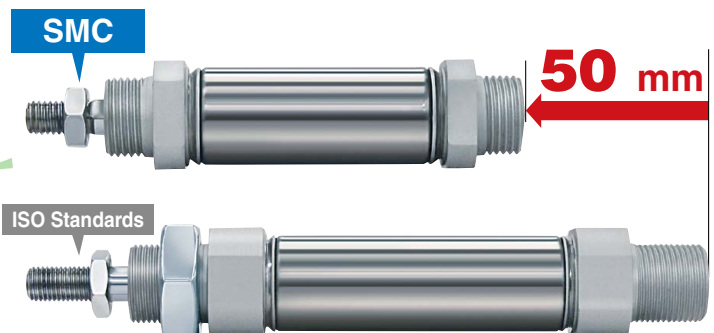
Air Cylinder

Overall length

27% reduction

Weight

44% reduction



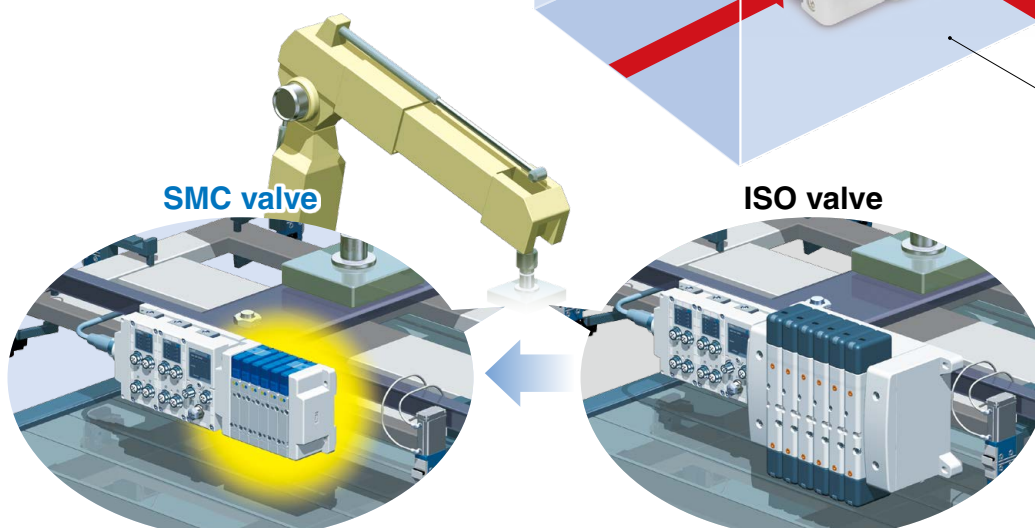
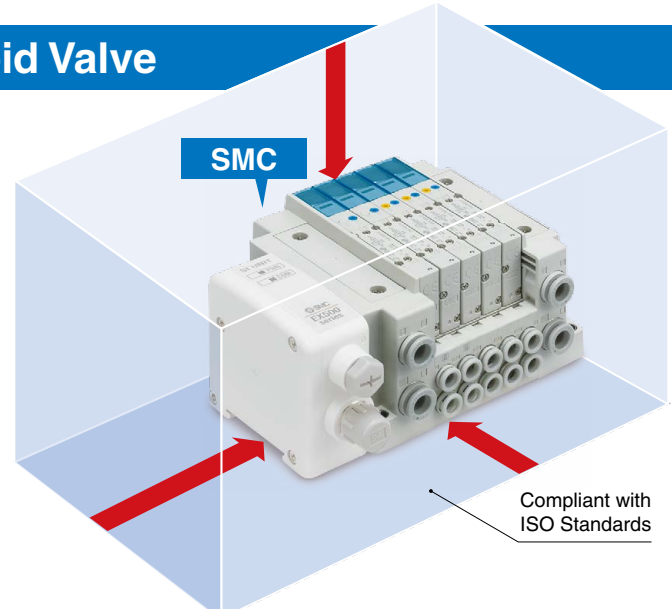
Solenoid Valve

Occupied volume

79% reduction

Weight

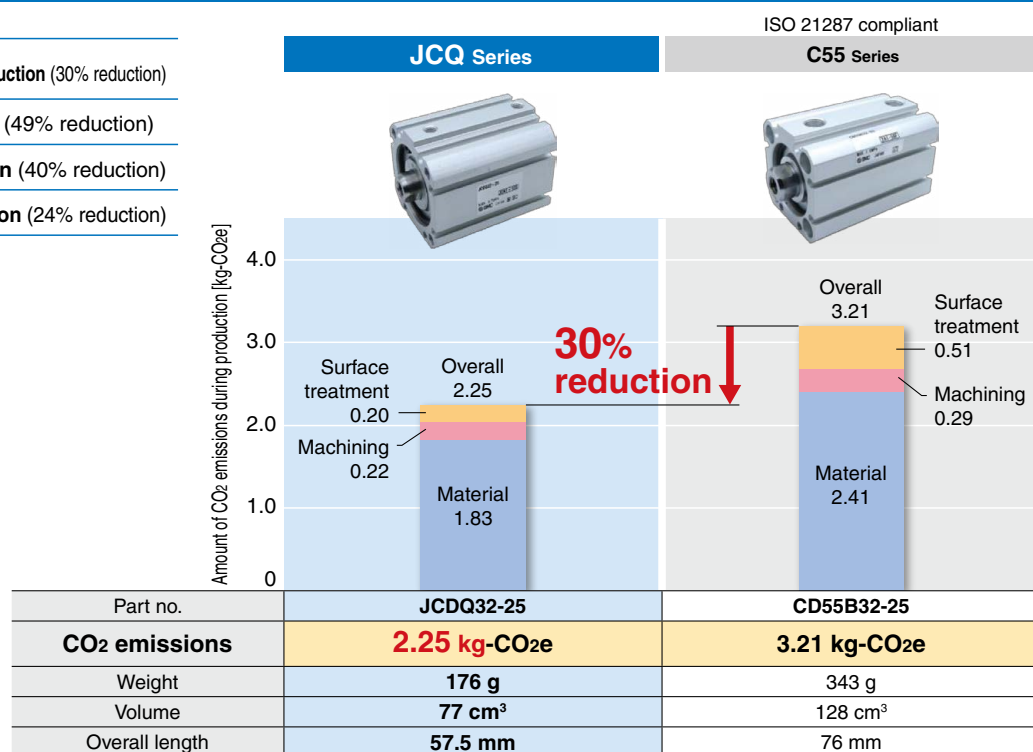
76% reduction



Compact Cylinder JCQ Series

CO₂ emissions: **30% reduction**

CO ₂ emissions	0.96 kg-CO₂e reduction (30% reduction)
Weight	167 g reduction (49% reduction)
Volume	51 cm³ reduction (40% reduction)
Overall length	18.5 mm reduction (24% reduction)

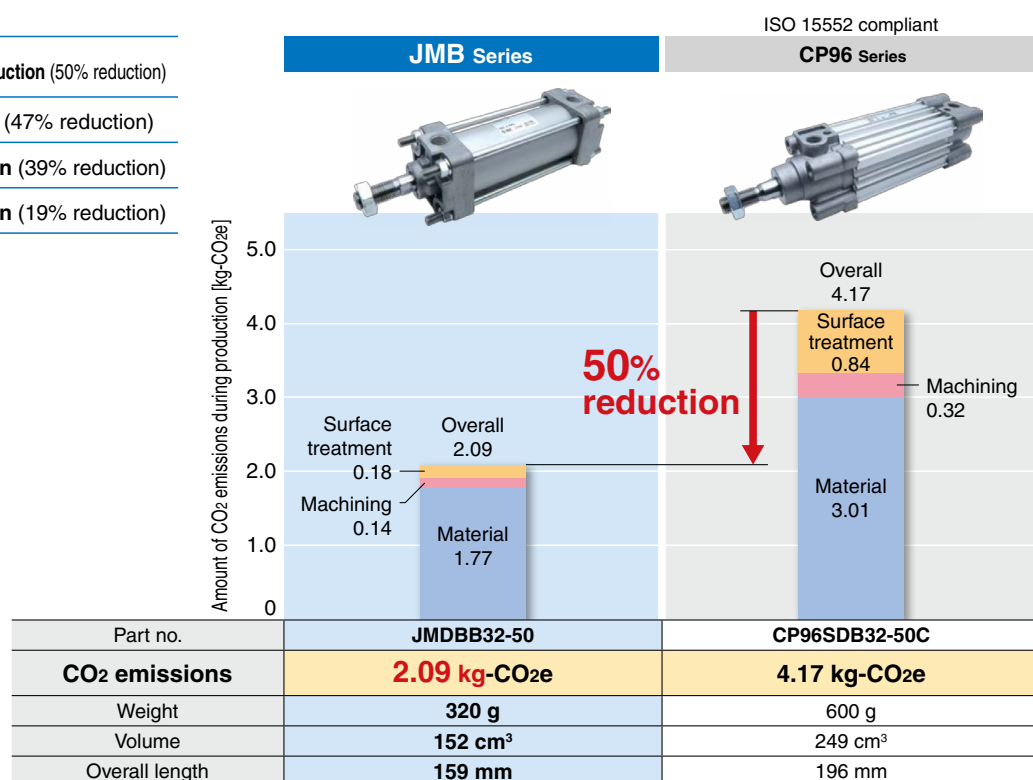


* For details on CO₂ emission calculation conditions (SMC's calculation method), refer to page 1.

Air Cylinder JMB Series

CO₂ emissions: **50% reduction**

CO ₂ emissions	2.08 kg-CO₂e reduction (50% reduction)
Weight	280 g reduction (47% reduction)
Volume	97 cm³ reduction (39% reduction)
Overall length	37 mm reduction (19% reduction)

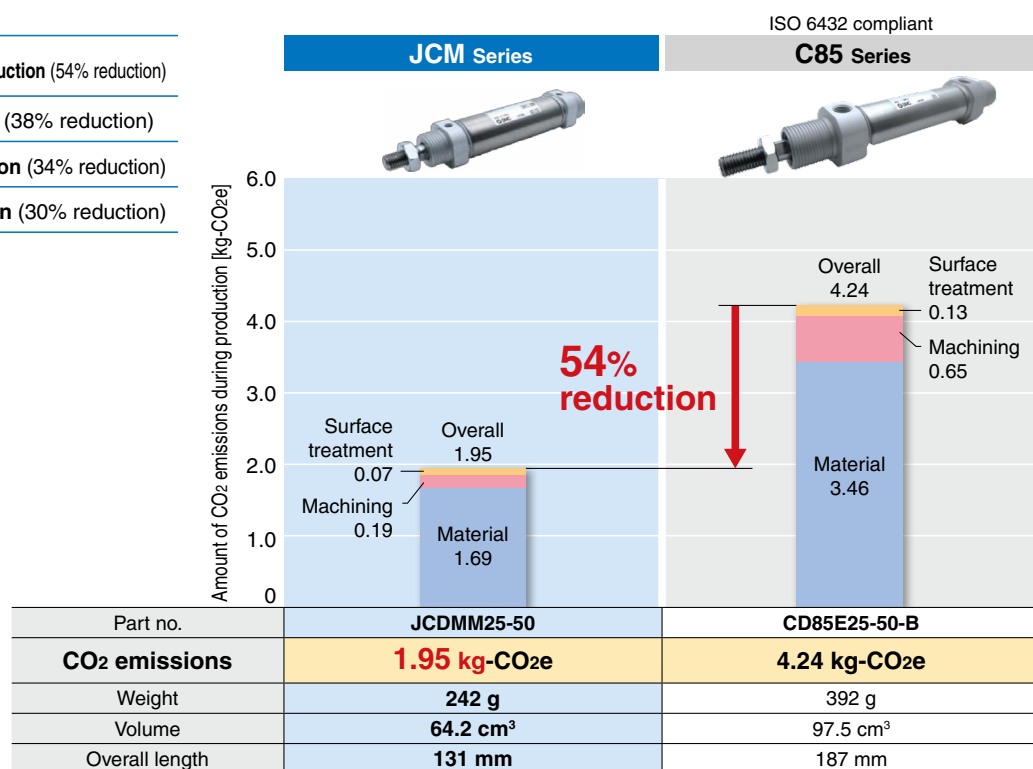


* For details on CO₂ emission calculation conditions (SMC's calculation method), refer to page 1.

Air Cylinder JCM Series

CO₂ emissions: **54% reduction**

CO ₂ emissions	2.29 kg-CO₂e reduction (54% reduction)
Weight	150 g reduction (38% reduction)
Volume	33.3 cm³ reduction (34% reduction)
Overall length	56 mm reduction (30% reduction)

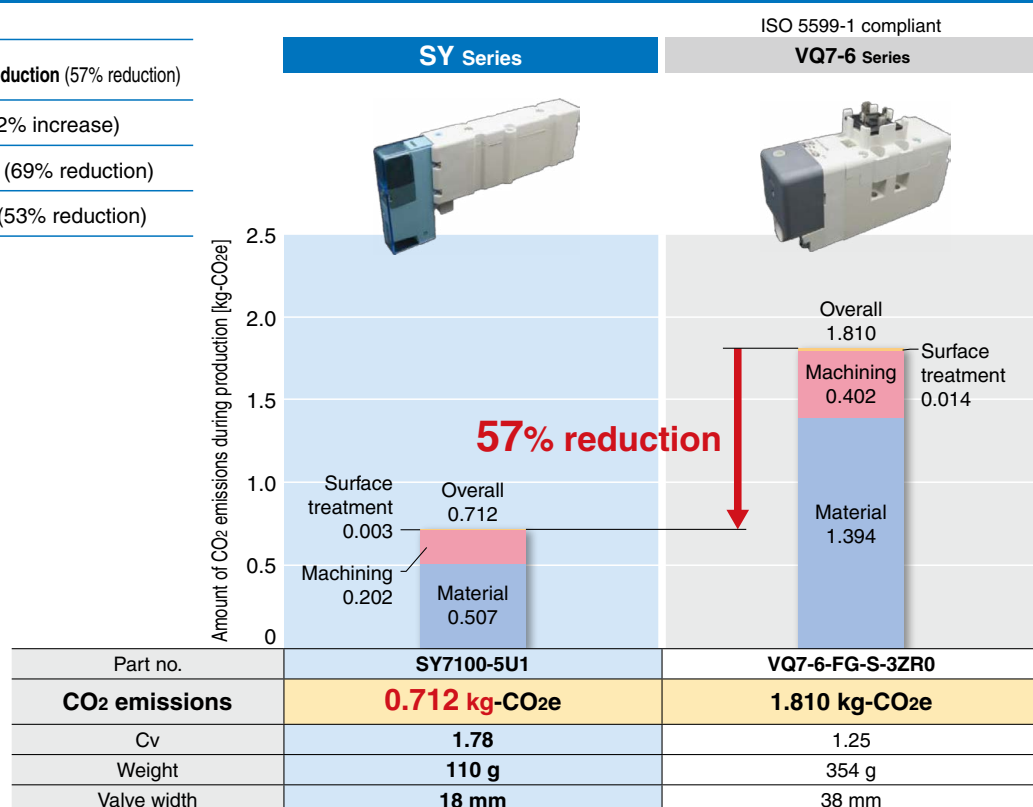


* For details on CO₂ emission calculation conditions (SMC's calculation method), refer to page 1.

5-Port Solenoid Valve SY Series

CO₂ emissions: **57% reduction**

CO ₂ emissions	1.098 kg-CO₂e reduction (57% reduction)
Cv	0.53 increase (42% increase)
Weight	244 g reduction (69% reduction)
Valve width	20 mm shorter (53% reduction)



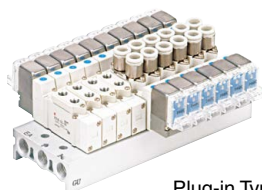
* For details on CO₂ emission calculation conditions (SMC's calculation method), refer to page 1.

The power-saving circuit can reduce CO₂ emissions (power consumption) when the device is energized.

CO₂ emissions
(Power consumption)

75%
reduction

SY Series

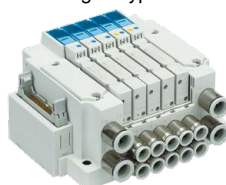


SY Series
Plug-in type

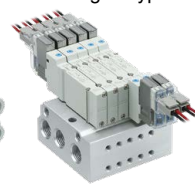


JSY Series

Plug-in Type



Non Plug-in Type



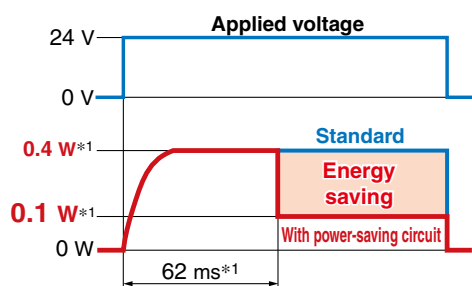
VP Series



• Reduces power consumption when energized

Power consumption can be reduced by approx. 1/4 by reducing the wattage required to hold the valve in an energized state. (Effective energizing time is over 62 ms*1 at 24 VDC.) Refer to the electrical power waveform as shown below.

Electrical power waveform with power-saving circuit



*1 SY/SYJ series

Low Wattage Valve

Energy-saving Product

Type	Model	Power consumption W*2	
		Standard	With power-saving circuit
4/5-port	SJ1000/2000	0.55	0.23
	SJ3000	0.4	0.15
	New SY3000/5000/7000	0.4	0.1
	SY3000/5000/7000	0.4	0.1
	JSY1000	—	0.2
	JSY3000/5000	0.4	0.1
	SYJ3000/5000/7000	0.4	0.1
3-port	V100	0.4	0.1
	SYJ300/500/700	0.4	0.1
	VP300/500	0.4	—
	VP700	1.55	0.55

*2 With DC light

Energy-saving Model

SY: 0.1 W

When the energizing time is 8 hours/day, 365 days/year

Power consumption per valve:

292 Wh/year

CO₂ emissions: **0.17 kg/year**

0.52 kg reduction in annual CO₂ emissions

(¥4.3/year)

(¥13.2/year reduction)

Effects of
Energy
Saving

Existing Model

SY: 0.4 W

When the energizing time is 8 hours/day, 365 days/year

Power consumption per valve:

1168 Wh/year

CO₂ emissions: **0.69 kg/year**

(¥17.5/year)

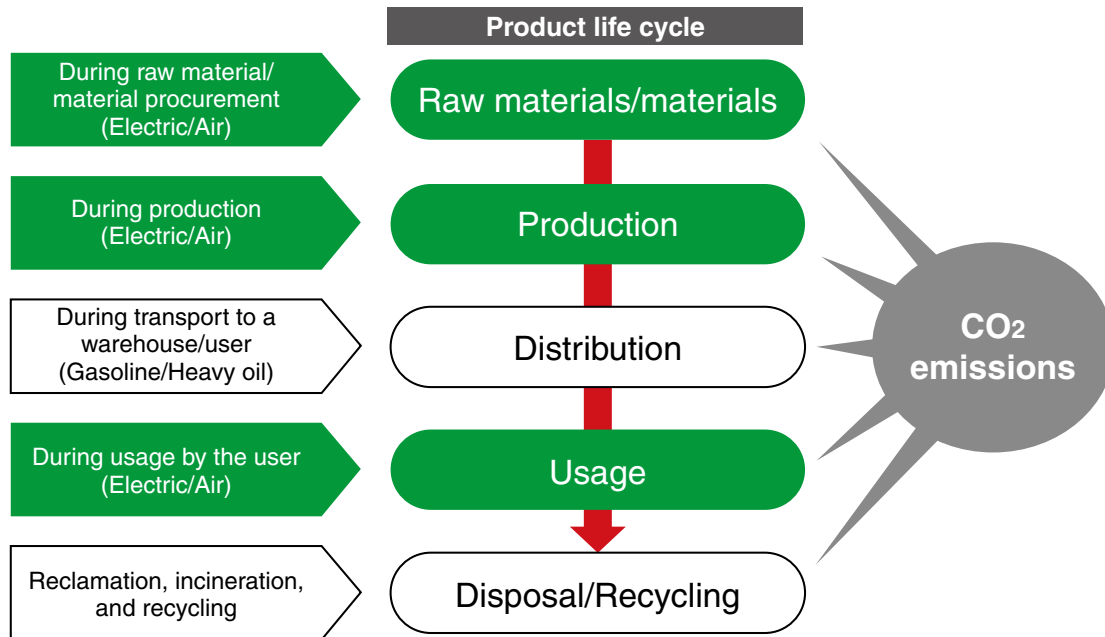
Energy-saving Model

Existing Model

Corresponding value: Electricity unit ¥15/kWh, Power consumption – CO₂ conversion factor 0.587 kg - CO₂/kWh

Product CO₂ emissions by carbon footprint formula

SMC realizes the importance of calculating **not only the amount of greenhouse gasses emitted during the operation of a product but also those emitted during raw material procurement and production**. The total amount of emissions are then converted into CO₂ in order to find the total amount of CO₂ emitted by a product during its entire life cycle.



What is a carbon footprint?

The amount of greenhouse gasses (CH₄, N₂O, fluorocarbon, etc.) emitted from a product or service during its entire life cycle (from raw material procurement to disposal) converted and measured in CO₂ equivalents

Reference: LCA (life cycle assessment) is a methodology for assessing the environmental impacts (global warming, air pollution, energy depletion, etc.) associated with a product or service during its entire life cycle, whereas a carbon footprint only assesses the amount of greenhouse gas (CO₂) emissions.



SMC Support Program

By providing the latest pneumatic technology, SMC continues to create solutions for your automation needs.

1 DEDICATED CORPORATE ACCOUNT MANAGER

An SMC Corporate Account Manager is assigned as your one-point person of contact. They work closely with your Corporate HQ Sponsors, Engineers and all production facilities - to deliver, create, manage and execute all collaborative program objectives.

2 LOCAL FACTORY SUPPORT

SMC has over 6,000 local sales engineers in 83 countries to support all of your local production facilities.

3 DESIGN ENGINEERING SUPPORT

To fully support your Engineers - SMC has 1600 dedicated R&D Engineers that can develop new products or solutions. SMC can quickly customize or modify existing components to meet design standards or unique applications.



With 12 support programs focusing on energy-saving activities

7 COMPRESSED AIR ENERGY SAVINGS ASSESSMENTS

SMC has developed a Streamlined Energy Savings Assessment program for our Corporate Accounts. Our goal is to find innovative solutions to reduce waste of compressed air in the factory environment.

8 MACHINE ANALYSIS ASSESSMENTS

SMC will perform plant level machine analysis to improve machine performance, identify waste, reduce scrap rate and improve line efficiency.

9 STOREROOM ASSESSMENTS

SMC will perform plant level storeroom assessments to reduce vendor base, eliminate duplication, standardize components, identify critical spares and offer cost savings solutions.

4 MACHINE SAFETY SUPPORT

SMC will work with your Engineering and local facilities for design assistance related to plant safety upgrades to meet ISO 13849-1 or other Machine Directives.

5 OEM MACHINE SUPPLIER SUPPORT

SMC will support your OEM Machine suppliers with the integration of SMC specified components. SMC will provide pricing support, innovative design assistance and SMC project management to ensure on-time delivery and commissioning of new machines or lines.

6 CRITICAL SPARE PARTS FOR NEW OEM MACHINES

SMC will work with local factories receiving new OEM machines - to ensure all critical spare parts are available and onsite prior to production.



10 HIGH USAGE SPARE PARTS ANALYSIS

SMC will work with all local plants to identify high usage pneumatic components. SMC will conduct failure mode analysis and offer robust alternatives to ensure better performance and uptime on machines where components are used.

11 IMPROVEMENT ACTIVITY REPORTS

SMC will document all Corporate Account application successes with Improvement Activity Reports (IAR's). These IAR's are a one-page overview of the application - highlighting operational improvements, energy savings, cost savings details or plant process improvements. These IAR's are designed to be shared with other facilities to duplicate activity.

12 ONSITE & ONLINE TRAINING CLASSES

SMC offers customized onsite and online training classes - on a variety of subjects related to pneumatic components, electric actuators, energy savings, optimal machine design and TPM methodologies.



Sustainable Management of CO₂

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